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# Effects of Terrorist Attacks on Tourist Flows to France: Is Wine Tourism a Substitute for Urban Tourism?

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# Abstract

Numerous studies have shown that terrorist attacks at a tourist destination reduce the level of inbound tourism and encourage tourists to travel to neighboring destinations. However, few studies have examined how terrorist attacks influence the substitution effect between different forms of tourism within the destinations at which the attacks take place, such as the substitution between wine (rural) tourism and urban tourism. This two-stage study examines the effects of terrorist attacks on international tourist flows to France. A gravity model is first estimated to assess the effect of terrorist attacks on the total inbound tourism demand. A system of equations models is then estimated to assess the substitution effects between the seven major wine tourism regions and the urban areas in which the attacks occur. The results demonstrate that terrorist attacks have a negative effect on inbound tourist flows to France and that wine tourism serves as a substitute for urban tourism following terrorist attacks.



*Keywords:* Terrorist attacks; tourism demand; wine tourism; substitution effect; Gravity model.

# Introduction

Tourism is a fragile industry because the demand for travel is highly susceptible to natural (e.g., hurricanes, earthquakes) and anthropogenic disasters (e.g., terrorism, war, riots) (Ritcher & Waugh, 1986; Ryan, 1993). Human-caused disasters such as terrorist attacks tend to have more profound effects than natural disasters (Glaesser, 2006). In recent decades, numerous terrorist attacks have occurred around the world, and these attacks have had catastrophic effects on some tourist destinations (Sönmez, Apostolopoulos, & Tarlow, 1999). Given the increasing frequency of terrorist incidents around the world, it is worth examining how terrorism affects tourism demand (Llorca-Vivero, 2008).

The effects of terrorism on tourism demand have been well documented in the politics and economics literature. Earlier studies relied mostly on qualitative research methods and sought to identify the negative effects of terrorism in places such as Ireland (Wall, 1996), Cyprus (Mansfeld & Kliot, 1997), and Egypt (Wahab, 1996). More recent research on the effects of terrorism has shifted from the use of qualitative approaches (mostly case studies) to econometric approaches based on time series, cross-sectional, or panel data (e.g., Buigut, 2018; Gergaud, Livat, & Song, 2018; Fareed et al., 2018; Llorca-Vivero, 2008). These studies generally confirmed that terrorism can cause immediate and precipitous declines in visitor numbers and that recovery can be very slow.

Despite these findings, researchers have continued to advocate for more rigorous and insightful quantitative analyses in the tourism and hospitality fields (e.g., Corbet et al., 2019; Lanouar & Goaied, 2019). Most prior studies were conducted in politically fragile developing countries that have witnessed significant numbers of terrorist attacks. Research has also suggested, albeit with little empirical evidence, that terrorism tends to be less consequential for developed countries because their economies are more resilient to turmoil (Blomberg, Hess, & Orphanides, 2004; Thompson, 2011).

Accordingly, the impact of terrorism on international tourism must be assessed using rigorous research methods. Empirical studies have also shown that although terrorist attacks have had strongly negative effects on the image and attractiveness of some destinations, other destinations have benefited from certain terror events because tourists tend to replace risky destinations with safer ones when there is a threat of terrorism (Araña & León, 2008; Bassil, Saleh, & Anwar, 2019; Drakos & Kutan, 2003; Neumayer & Plümper, 2016). However, the generalizability of the substitution effect remains in question. In particular, *it remains unknown whether this substitutability manifests between different forms of tourism within a single destination, such as wine (rural) tourism and urban tourism.*

With the above considerations in mind, this study documents the effects of terrorism on international tourist flows to France and examines the potential substitution effects between different forms of tourism within the country. France has a lengthy history of terrorist attacks. From 2010 to 2017, numerous attacks occurred in or near Paris. In such cases, urban tourism faces greater risks than rural (wine) tourism. Hence, the question arises as to *whether these terrorist attacks have affected inbound tourist flows to France and whether wine tourism, conceived as an example of rural tourism (Carmichael, 2005), has become a substitute for urban tourism (tourism in Paris) in France.*

To answer these questions, this study was conducted in two stages based on monthly time series data from January 2010 to October 2016. In the first stage, a gravity model was used to examine the effect of terrorist attacks on the total number of international tourist arrivals in France. In the second stage, a system of equations approach was used to explore the substitution effects between seven major wine tourism regions (Auvergne-Rhône-Alpes, Grand Est, Bourgogne-Franche-Comté, Nouvelle-Aquitaine, Occitanie, Pays-de-la-Loire and Provence-Alpes-Côte-d'Azur) and the major urban area in which most of the attacks have occurred, Île-de-France.

# Literature review

## Terrorism and tourism

A rapid increase in terrorist attacks occurred during the second half of the 20th century, especially in the 1960s and 1970s, and terrorism has become a global challenge that affects numerous societies and economies around the world. “Terrorism” refers to acts of premeditated violence or threats of violence by organized groups against civilians or unarmed military personnel that are designed to achieve political, religious, or ideological goals (Breda & Costa, 2006). In essence, terrorism is a violent form of political communication that depends heavily on modern means of communication (e.g., television, the Internet) to transmit messages to a mass audience (the government or the public) that are intended to modify the recipients’ emotions and/or behavior (Weinberg & Eubank, 2006).

Paradoxically, international tourism and terrorism share similar characteristics in that they involve activities that cross national borders, citizens of different countries, and the use of travel and communications technologies (Schlagheck, 1988; Sönmez & Graefe, 1998). Because the goal of a terrorist attack is to create public fear and confusion, tourist sites, which are usually a focus of media attention, are preferred by terrorists. Attacks on tourist areas can have significant effects on national and local economies and generate negative feelings among the targeted populations (Goeldner & Ritchie, 2009). Although terrorists may not intentionally target tourists, they often become victims because they are in the wrong place at the wrong time (Pizam, 2002) or because the terrorists’ disregard for the potential risks results in loss of life (Wilks, Pendergast, & Leggat, 2006). Thus, the tourism sector tends to be strongly affected by terrorist attacks (Piterman, 2000). This vulnerability can be attributed to the characteristics of tourist services, which are highly perishable and cannot be stored and sold at another time (Drakos & Kutan, 2003).

The impact of terrorism on tourism has received considerable attention in the tourism literature. Studies have been undertaken in various countries and regions, such as Turkey (Feridun, 2011), Greece (Drakos & Kutan, 2003), Israel (Bar-On, 1996), Spain (Enders & Sandler, 1991), and Thailand (Fareed et al., 2018). One of the common findings of these studies is that the demand for tourism is negatively affected by terrorist attacks. For examples, Corbet et al. (2019) confirmed such impact in Europe, and Lutz and Lutz (2018) in the Caribbean countries. The devastating effects of terrorism is much stronger than political violence. In the case of Tunisia, for example, the effects of terrorist attacks on tourist arrivals and overnight stays had a longer duration than political riots (Lanouar and Goaied, 2019). Such effect also differs from country to country. Using a cross-sectional gravity model, Llorca-Vivero (2008) estimated that the impact of terrorism on international tourist flows from the G7 countries is more severe that from in the developing countries. On the other hand, Buigut (2018) compared the effects of terrorist attacks on the demand for tourism in Kenya from different countries and found that terrorist attacks significantly reduce tourist arrivals from the developed countries but not from emerging economies. The terrorism-induced impact on tourism has its root in consumer choice theory. Recently, Walters, Wallin, and Hartley (2019) confirmed that the threat of terrorism has profound impact on tourists' choices in both accommodation and trip arrangement.

## Terrorism and tourist decision making

The effects of terrorism on the aggregate demand for tourism are a macro-level representation of its effects on the decision-making processes of individual tourists (Sönmez & Graefe, 1998). As pleasure travelers, most tourists are risk-averse and tend to seek destinations that provide the maximum personal benefits at the lowest possible risk. In contrast, terrorist attacks are designed to have a significant psychological impact and to spread fear among innocent people. Terrorists also intentionally plan for the

attacks to appear to be random so that everyone at the destination feels at risk (McKercher & Hui, 2004). Thus, terrorist attacks increase the perceived risks of injury and loss of life and belongings (Seabra, Abrantes, & Kastenholz, 2014). These perceived risks are often psychologically exaggerated because people tend to overestimate the likelihood of such catastrophic events while ignoring the dangers that they are more likely to encounter in everyday life (Enders & Sandler, 2004).

Given the risks associated with terrorism, tourists tend to cancel or postpone their travel plans or travel to safer destinations when they hear of terrorist attacks (Bonham, Edmonds, & Mak, 2006; Reisenger & Mavondo, 2005). These individual decisions are likely to be reflected at the macro level in the rapid decline in tourist flows to the destinations in which incidents have occurred and the diversion of the flows to alternative destinations or forms of tourism. From this perspective, terrorism can be seen as having *direct negative effects* and *cross-regional (or cross-country) substitution effects* on tourism.

## Terrorism and tourism demand: direct effects

Terrorist attacks have been found to cause sharp reductions in tourist arrivals and expenditure in incident regions (Sönmez, Backman, & Allen, 1994). Terrorism can cause immediate precipitous declines in the numbers of tourists who visit a destination, and these are followed by a very slow process of recovery (Seddighi, Nuttall, & Theocharous, 2001). Wahab (1996) found that Egypt experienced a 43% decline in tourist receipts following the terrorist attacks in 1992. Ender and Sandler (1991) and Enders, Sandler, and Parise (1992) used econometric analyses to show that terrorism has had significant negative effects on tourism revenues in Spain and other European countries. Similar negative effects have been found in tourism destinations in Kenya (Buigut & Amendah, 2016).

The strength of the effects of terrorism depends mainly upon the severity and frequency of the attacks (Pizam, 1999; Krakover, 2005). Terrorist acts that cause more

casualties and/or damage tend to have more devastating effects on tourism demand. Moreover, multiple terrorist attacks in succession can have much more serious long-term effects. In contrast, the negative effects of infrequent attacks tend to be relatively shorter in duration (Pizam, 1999). Bassil (2014) and Drakos and Kutan (2003) found that the intensity and location of the incident and the number of casualties determine the level of impact. Fletcher and Morakabati (2008) concluded that severe terrorist incidents have more significant effects on tourist demand than low-medium one-off terrorist attacks. Pizam and Fleischer (2002) found that more frequent incidents are likely to have long-lasting effects and can even lead to the complete collapse of the tourism market.

However, there is a time lag before a terrorist attack affects the local tourism market (Bac, Bugnar, & Mester, 2015). Fleischer and Buccola (2002) found that on average, it takes about 2 months for tourist numbers to be affected by a terrorist attack. Lee and Sanugi (2010) found that the negative effects of the Bali bombings began to be felt after a 6- to 12-month delay. Enders, Sandler, and Parise (1992) found that terrorist attacks took around 3 months to affect tourist demand.

Notably, the effects of terrorism on tourism are temporary (Aly & Strazicich, 2000), and tourism industries typically recover eventually (Gut & Jarrell, 2007). UNWTO (2001) reported that a gradual recovery in the tourism industry began one month after the September 11 attack. Most tourists have relatively short memories and will resume traveling when they feel that the immediate threat has passed (Mckercher & Hui, 2004). One-off events tend to have short-term effects, whereas a persistent history of terrorist attacks at a destination can have long-lasting effects on tourist flows (Leslie, 1999). Other factors, such as a potential tourist's psychological proximity to a destination, may also influence how a destination recovers from a terrorist attack (Clements & Georgiou, 1998).

## Terrorism and tourism: substitution effects

The negative effects of terrorism are not confined to the destination at which an incident occurred because they can also have spillover effects on adjacent regions (Neumayer & Plümper, 2016). That is, in addition to deterring tourists from traveling to the affected destination, a terrorist attack can reduce the number of tourist arrivals in neighboring destinations. Thus, even though the neighboring destinations have not directly experienced terrorism, they may see declines in tourist arrivals and expenditure. This phenomenon is also known as a "negative externality" or "contagious effect" (Drakos & Kutan, 2003). As a result, the numbers of tourists who visit the general region in which an attack occurred may decline (Ryan, 1991). The explanation for the spatial spillover effect is that tourists have a good understanding of the logic of transnational terrorism. That is, they consider the terrorists' aims to be arbitrary and believe that they could have attacked similar targets in similar destinations. Tourists are thus likely to bypass alternative destinations in addition to avoiding the country in which the attack took place.

The externality of terrorism can also take the form of a substitution effect in which some neighboring destinations gain from the problems experienced in the targeted country because tourists change their travel plans and substitute low-risk destinations for high-risk locations (Drakos & Kutan, 2003). Ender and Sandler (1991) and Enders, Sandler, and Parise (1992) used monthly data and time series analyses to examine the substitution effects between destinations. Drakos and Kutan (2003) extended the analysis of Enders, Sandler, and Parise (1992) and depicted the relationships between neighboring destinations as a zero-sum game in which total tourist revenues remain the same but tourists switch from the incident destinations to safer ones.

In this sense, terrorist attacks may alter the regional competition landscape. However, this substitution effect is not confined to the spatial dimension. For example, Baker (2014) found that the 9/11 attacks induced a drift away from air travel to other

forms of transportation. Bonham et al. (2006) found a substitution effect between international and domestic tourism within the United States. Such a substitution effect may also exist between different forms of tourism within a destination.

## Wine tourism

Wine tourism refers to the act of visiting a wine region to experience wine tasting and/or the attributes of the region (Hall, Sharples, Cambourne, & Macionis, 2000). Typically, wine tourism destinations encompass grapes, the natural environment, and the viticulturists and winemakers who determine every aspect of the wine, from the varieties of grapes, the spacing of the vines, and the trellising systems to the final products that enter the bottles (Telfer, 2000). Since the 1990s, an increasing number of studies have examined wine tourism (Mitchell & Hall, 2006), focusing mainly on its effects on regional development (Hall, Lamb, Holzapfel, & Louis, 2002), visitor motivation (Sparks, 2007), and experience (Bruwer & Alant, 2009). Researchers have also noted the impact of terrorism on wine tourism. For example, using daily data, Gergaud, Livat, and Song (2018) estimated the impact of terrorist attacks on tourist demand in terms of attendance at a wine museum in the city of Bordeaux. They found that 14 successive terrorist attacks over 426 days caused the institution to lose about 5000 tourists. However, few studies have examined the substitution effect of wine tourism in relation to urban destinations, which tend to be the targets of terrorists.

French wine is one of the most iconic products in the world, and 50 million hectoliters of still wine was produced in France in the year of 2018 (European Commission, 2019). Wine tourism is also a huge industry in France, which is one of the world's primary wine tourism destinations. Travelers can experience a multitude of well-known French vineyards and explore various smaller vineyards. France's major wine-producing areas are situated in seven distinct administrative regions (Auvergne-Rhône-Alpes, Bourgogne-Franche-Comté, Nouvelle-Aquitaine, Grand-Est, Occitanie, Pays-de-la-Loire, and Provence-Alpes-Côte-d'Azur), which are major wine tourism

destinations (Table 1).

Table 1. Profile of the seven study regions (as of 2016)

| | Wineries | %Total | Vineyard (ha) | %Total | Wine (hl) | %Total | % wine tourists |
|---|---|---|---|---|---|---|---|
| Auvergne-Rhône-Alpes | 8164 | 9.41 | 48548 | 6.69 | 2572222 | 5.99 | 21.8 |
| Bourgogne-Franche-Comté | 5487 | 6.32 | 36265 | 5.00 | 1363906 | 3.18 | 18.6 |
| Nouvelle-Aquitaine | 18432 | 21.25 | 215874 | 29.76 | 15539115 | 36.17 | 30 |
| Grand-Est | 18905 | 21.79 | 46405 | 6.40 | 2977158 | 6.93 | 34.1 |
| Occitanie | 24188 | 27.88 | 257152 | 35.45 | 14936695 | 34.77 | 18.5 |
| Pays-de-la-Loire | 2846 | 3.28 | 31519 | 4.35 | 1382208 | 3.22 | 13 |
| Provence-Alpes-Côte d'Azur | 8729 | 10.06 | 89563 | 12.35 | 4185309 | 9.74 | 11.5 |

Source: Atout France

# Methods and Data

The primary objective of this study was to estimate how terrorist attacks have affected the volume and pattern of international tourism flows to France. The study was conducted in two stages. The first stage assessed the direct effects of terrorist attacks on inbound tourist demand, and the second stage evaluated the substitution effects between an urban destination (i.e., Paris) and the major wine tourism destinations. These two stages correspond to the two-stage tourist budget allocation process (Blackorby, Primont, & Russell, 1978). In the first stage, international tourists choose between French destinations and non-French destinations. In the second stage, they make their decisions to travel to different regions within France.

Following Buigut and Amendah (2016), the intensity of a terrorist attack was measured using the total casualties, whereas the location and incidence of terrorism were captured using location dummies. These variables are consistent with those used by Yaya (2008) and Enders and Sandler (1996). Based on the casualty figure series and incidents series, the direct effects of terrorism were assessed using a gravity model, and the substitution effects were assessed using a compositional data-based equation system.

## Terrorism and inbound tourist flow: Gravity model

The gravity model (Tinbergen, 1962) and its adjusted forms have been widely and successfully applied to issues related to international trade flows (Anderson & Van Wincoop, 2003) and migration (Gallardo, Pareja, Llorca-Vivero, & Martínez-Serrano, 2006). The model has also been used to estimate the effects of terrorism on tourism demand (e.g., Llorca-Vivero, 2008). Notably, the gravity model was initially proposed to estimate the cross-sectional variations in tourism demand. However, in the case of a single pair of countries, the relevant variables may change over time. Therefore, such a cross-sectional model is assumed to behave similarly in longitudinal contexts.

The gravity model (in analogy to Newtonian physics) can be generally specified

as

$$F_{ij} = \beta_0 \frac{M_i^{\beta_1} M_j^{\beta_2}}{(D_{ij})^{\beta_3}} u_{ij}$$

where $F_{ij}$ is the tourist flow from origin country $i$ to destination country $j$, $M_i$ and $M_j$ denote the size of their respective economies, $D_{ij}$ is the distance between the origin and the destination, and $u_{ij}$ is a normally distributed error term.

In the gravity model, the size of an economy represents both the supply and demand sides, and the population and GDP per capita are commonly used as indicators. It is evident that origin countries with larger populations and higher GDP are likely to generate greater tourism demand for a destination. It is reasonable to assume that larger and richer destinations are more likely to provide more or better tourism services. Moreover, distance is often used as a proxy for transport and/or time costs (Llorca-Vivero, 2008).

The original form of the gravity model can be log-transformed into a linear mode and augmented by additional variables that may influence tourist flows either positively or negatively (Liorca-Vivero, 2008). An important variable is price, which is included to avoid any kind of omission bias (e.g., Anderson, 1979). Commonly, the real CPI adjusted by the exchange rate is used to control for differences in the cost of living between the origin and the destination countries (Eilat & Einav, 2004; Liorca-Vivero, 2008).

The above considerations were all taken into account in the model specification. Following the literature, it was assumed that a terrorist attack that occurred in a capital city or had large numbers of casualties would have a more widespread impact. Therefore, a dummy variable to capture the incident location ($TerrP$) and a continuous variable to measure the number of casualties ($TerrN$) were added. Because the effects of terrorist attacks are usually lagged, dummy variables with four lags were created to examine the lagged effect and recovery time after a terrorist attack. Notably, in this single-pair context, the distance remains unchanged and was thus excluded from the

model.

Based on the above considerations, the following time series gravity equation was used:

$$lgTD_t = \beta_0 + \sum_{i=0}^{4} \beta_1^i TerrN_{t-i} + \sum_{i=0}^{4} \beta_2^i TerrP_{t-i} + \beta_3 lgPOPfrc_t + \beta_4 lgPOPori_t + \beta_5 lgGDPfrc_t + \beta_6 lgGDPori_t + \beta_7 lgRCPI_t + \mu_t$$

where

$TD_t$ is the inbound tourism demand in month $t$,

$TerrN_{t-i}$ is the total number of casualties caused by terrorist attacks in month $t-i$,

$TerrP_{t-i}$=1 if there were any terrorist attacks in the Paris region during month $t-i$, and 0 otherwise,

$POPfrc_t$ is the population of France in month $t$,

$POPori_t$ is the population of the aggregated places of origin, including 15 countries/regions in month $t$,

$GDPfrc_t$ is the GDP of France in month $t$,

$GDPori_t$ is the GDP of the origin regions in month $t$,

$RCPI_t$ is the bilateral real CPI adjusted by the exchange rate, which is used to measure the cost of living in France relative to that in the country of origin, and is computed as $CPI_{frc/ori} \times ER_{ori/frc}$, and

$\mu_t$ represents the normally distributed error.

## Cross-regional substitution effects: compositional data-based equations

The second stage of the investigation focused on the potential tourist flows from the frequently attacked Paris area to seven wine tourism regions. In the literature, these effects are typically modeled using a system of equations approach to predict the variation in the market shares of the destinations (e.g., Drakos & Kutan, 2003). Because

the aforementioned budget allocation process permits the ratio of the consumer demands for tourist activities in two different countries (or regions) to be independent of the income considerations (Enders, Sandler, & Parise, 1992), terrorist attacks are the only determinants of the variations in market share.

This systematic approach was used to estimate the effects of tourist attacks in the capital area (i.e., *Ile-de-France*) on the market shares of seven renowned wine tourism destinations in France: Auvergne-Rhone-Alpes ($MS_t^{Auv}$), Bourgogne-Franche-Comte ($MS_t^{Bog}$), Grand Est ($MS_t^{Gst}$), Nouvelle-Aquitaine ($MS_t^{Nov}$), Occitanie ($MS_t^{Occ}$), Pays-de-la-Loire ($MS_t^{Pay}$), and Provence-Alpes-Côte-d'Azur ($MS_t^{Pro}$). The market shares are represented by the percentages of international visitors received by these destinations.

To capture the severity of a terrorist attack, this study followed Drakos and Kutan (2003) and defined three intensity dummies:

$TA^0$=1 if there were no casualties, and 0 otherwise,

$TA^{1t3}$=1 if there were three or fewer casualties, and 0 otherwise, and

$TA^{3t}$=1 if there were more than three casualties, and 0 otherwise.

Based on the above considerations, seven equations were created to predict the market share of each wine tourism destination. To capture the potential lagged effect, six lagged variables were incorporated into the model. The model specification took the following form:

$$MS_t^i = \beta_0 + \sum_{j=0}^{6} \beta_1^j TA_{t-j}^0 + \sum_{j=0}^{6} \beta_2^j TA_{t-j}^{1t3} + \sum_{j=0}^{6} \beta_3^j TA_{t-j}^{3t} + u_t$$

where $MS_t^i$ is the market share of wine destination $i$ in month $t$, $j$ denotes the time lag of the effects of terrorist attacks (where 0 implies a contemporary effect), and $u_t$ represents the normally distributed error.

## Data

The time series covers January 2010 to October 2017. The monthly international tourist visits to each of the grand regions of France are published by the French Institute for Economic Studies and Statistics (INSEE). INSEE tracks the total nights of stay of foreign tourists from 13 countries (the United Kingdom, Germany, Belgium, Italy, Spain, Switzerland, the Netherlands, Russia, the United States, Canada, China, Japan, and Australia) and two regions (other European Countries, Central and South America) and records the total number of tourist arrivals in each grand region of France. The data on the total nights of stay were used to calculate the inbound tourism demand in France ($TD_t$), and the tourist arrival data for each grand region were used to calculate the market shares of the seven wine tourism destinations in each month ($MS_t^i$).

The monthly GDP ($GDPori_t$), population ($POPori_t$), CPI ($CPI_{ori}$), and exchange rates ($ER_{ori}$) of the aggregated places of origin were calculated as a weighted average of 15 countries/regions based on the percentage of inbound tourists from each country/region per year. The seasonal variations in tourist arrivals and monthly GDP were addressed using the *X-12 ARIMA* program. The monthly GDP, populations, CPI, and exchange rate data of the 15 origin countries/regions were collected from the statistics published by the Organization for Economic Co-operation and Development (OECD). The quarterly data were converted into monthly data by assigning equal numbers to the months in a quarter. Because the two origin regions (other European countries, Central and South America) comprise several countries, their GDP and population data were calculated by summing the figures for the major countries in the two regions, and their real CPIs were calculated as the average of their major countries.

Data on terrorist attacks were collected from news reports on terrorist attacks in France, with the date, place, fatalities/injuries, and a brief description of each attack incident being documented. These data were then trans-coded as a dummy variable ($TerrP,\ TA^i$) or continuous variable ($TerrN$).

# Results

## Descriptive data analysis

A thorough online investigation was conducted to identify the terrorist attacks that occurred in France during the study period (Table 2). It is evident that France suffered increasingly frequent terrorist attacks from 2010 to 2017. In 2010, there was one shooting that led to one fatality. In contrast, in 2016 and 2017, 16 terrorist attacks were recorded, including the severe incidents that occurred in the July 2016 (86 fatalities and 434 injuries) and November 2015 attacks (130 fatalities and 368 injuries). Of the 26 incidents that occurred during the overall period, 15 were situated in the grand region of Île-de-France (Paris and its periphery), and 2 out of the 3 severe attacks (i.e., those that caused more than 10 fatalities) occurred in this region.

Table 2. Terrorist attacks in France (Jan 2010 – Oct 2017).

| Date | Type | Fatality | Injury | Location |
|---|---|---|---|---|
| 2010-3 | Shooting | 1 | 0 | Île-de-France |
| 2012-3 | Shooting | 7 | 5 | Occitanie |
| 2013-5 | Stabbing | 0 | 1 | Île-de-France |
| 2014-12 | Stabbing | 1 | 3 | Centre-Val de Loire |
| 2015-1 | Shooting | 17 | 22 | Île-de-France |
| 2015-2 | Stabbing | 0 | 3 | Provence-Alpes-Côte d'Azur |
| 2015-4 | Shooting | 1 | 0 | Île-de-France |
| 2015-6 | Beheading | 1 | 2 | Auvergne-Rhône-Alpes |
| 2015-8 | Shooting and stabbing | 0 | 4 | Hauts-de-France |
| 2015-11 | Shootings, hostage-taking, and suicide bombings | 130 | 368 | Île-de-France |
| 2016-1 | Vehicle ramming | 0 | 2 | Auvergne-Rhône-Alpes |
| 2016-1 | Stabbing | 1 | 0 | Île-de-France |
| 2016-6 | Stabbing | 2 | 0 | Île-de-France |
| 2016-7 | Vehicle ramming | 86 | 434 | Provence-Alpes-Côte d'Azur (Nice) |
| 2016-7 | Stabbing | 0 | 4 | Provence-Alpes-Côte d'Azur |
| 2016-7 | Stabbing | 3 | 1 | Normandy |
| 2016-8 | Stabbing | 0 | 1 | Grand Est |
| 2016-9 | Stabbing | 0 | 1 | Île-de-France |
| 2017-2 | Stabbing | 0 | 1 | Île-de-France |
| 2017-3 | Letter bomb | 0 | 1 | Île-de-France |
| 2017-3 | Shooting | 1 | 1 | Île-de-France |

| | | | | |
|---|---|---|---|---|
| 2017-4 | Shooting | 2 | 3 | Île-de-France |
| 2017-6 | Melee attack | 0 | 1 | Île-de-France |
| 2017-6 | Car ramming, explosive attack, and planned shooting | 1 | 0 | Île-de-France |
| 2017-8 | Vehicle ramming | 0 | 8 | Île-de-France |
| 2017-10 | Stabbing | 3 | 0 | Provence-Alpes-Côte d'Azur |

The changes in the inbound tourism demand (total nights of stay) and market shares of the seven wine tourism regions during the study period are presented in Figures 1 and 2, respectively, along with the contrasts between the trends before and after adjusting for seasonality. The results show significant seasonal variation before adjustment, with peaks in June and July and troughs in December and January. To exclude the seasonality effects, the data were adjusted using the software X-12-ARIMA, as suggested by the US Census Bureau, before being entered into the regression. The figures show that after adjustment, the seasonality effects are mitigated.

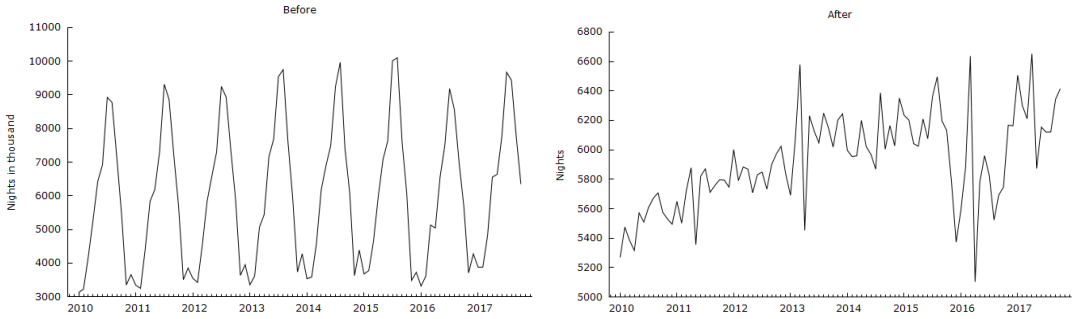


Figure 1. Inbound tourism demand for France (seasonality adjustment).

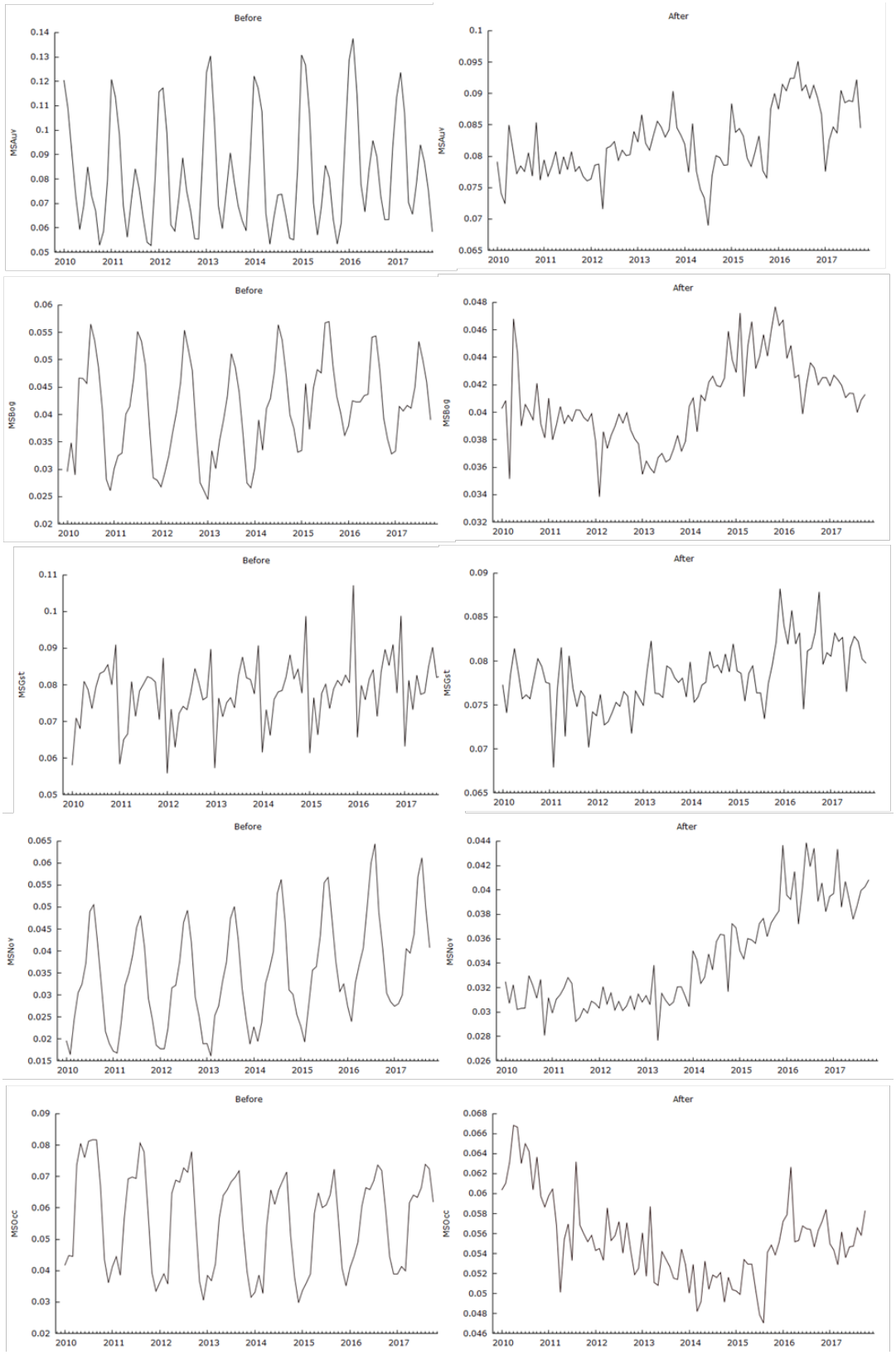


Figure 2. Market shares of the wine tourism regions: seasonality-adjusted.

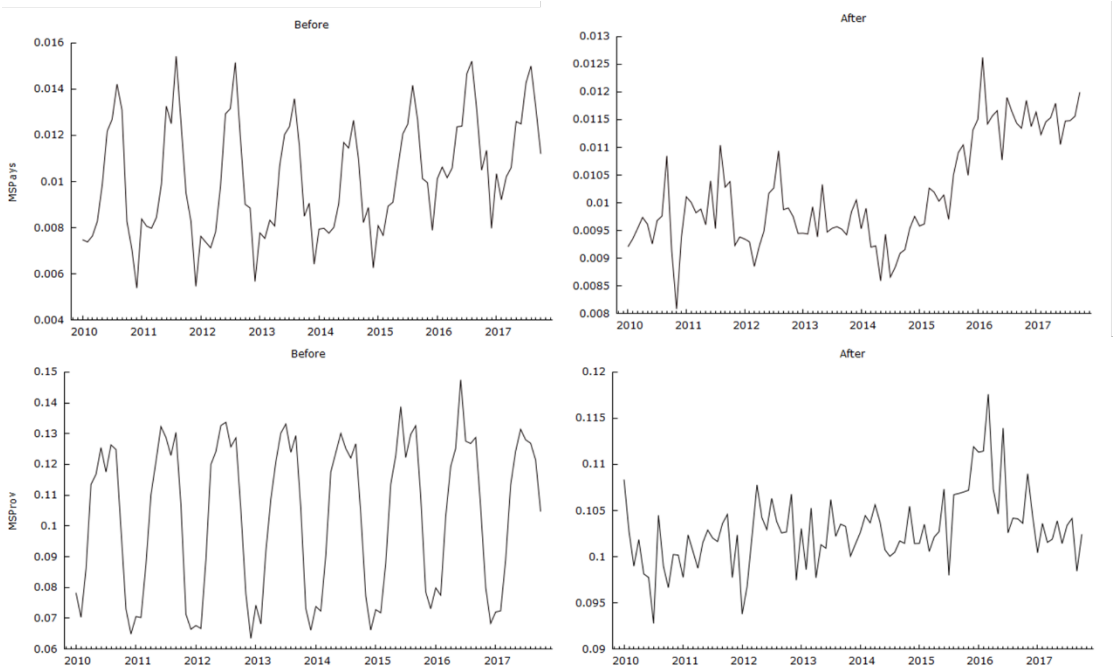


Figure 2. Market shares of the wine tourism regions: seasonality-adjusted (continued)

Table 3 presents the results of a stationarity check (unit root test) for the total inbound tourism demand and the market shares for the seven wine tourism regions after the seasonality adjustment. For each time series, at least two of the three tests statistics suggest that the time series is stationary.

Table 3. Stationarity check

| | Phillips–Perron test p-value | Elliott–Rothenberg–Stock test p-value | Ng–Perron test p-value |
|---|---|---|---|
| Total nights of stay | <0.01 | *>0.1* | <0.05 |
| MSAuv | <0.05 | <0.01 | <0.05 |
| MSBog | <0.01 | <0.01 | <0.01 |
| MSGst | <0.01 | *>0.1* | <0.01 |
| MSNov | *>0.1* | <0.1 | <0.05 |
| MSOcc | <0.01 | <0.05 | <0.05 |
| MSPays | <0.1 | *>0.1* | <0.1 |
| MSProv | <0.01 | <0.01 | <0.01 |

## Direct effects of terrorism on inbound tourist flows

The effects of the terrorist attacks on the inbound tourism demand in France are shown in Table 4. Attack severity (total casualties) is immediately and significantly negatively associated with the total inbound tourism demand. This implies that although terrorist attacks only occurred at a few sites, they reduced the inbound tourist flow to the entire country, and this negative effect depended on the severity of the attack. This finding is consistent with previous studies (e.g., Enders & Sandler, 1991; Buigut & Amendah, 2015) and confirms the existence of spillover or contagious effects (Bassil, 2014; Neumayer & Plümper, 2016). Studies have shown that terrorist attacks tend to take several months to affect tourism demand (Bac, Bugnar, & Mester, 2015), but such a lagged effect was not observed in this study. Of the four lagged variables, three ($TerrN_{t-1}$, $TerrN_{t-2}$, $TerrN_{t-3}$) demonstrated significant negative effects, which suggests that the negative effects of a terrorist attack last around three months and that inbound tourist flows begin to recover from the fourth month onward. This is consistent with studies that showed that the effects of terrorist attacks on tourism are temporary (Aly & Strazicich, 2000) and that the tourism industry tends to recover from terrorist attacks within a relatively short period (Gut & Jarrell, 2007).

No significant effects were found for location (*TerrP*) for either the non-lagged or lagged variables. These results suggest that tourists are affected by the severity of terrorist attacks rather than their location, such as in the capital area or other regions. Given the lack of research on the effect of location, this finding is not surprising.

The gravity model was used to consider the effects of population, GDP, and CPI. The results show that the populations of France (*POPfrc*) and the origin countries (*POPori*) had no significant effects on the total inbound tourism demand. Similarly, the GDP of France and the real CPI had no significant effects on inbound tourism demand. The gravity model was initially designed to examine cross-sectional variations, and the population, GDP of France, and CPI varied significantly across the different country

pairs. However, in this longitudinal research setting, the variations were so small that they were barely captured by the three variables. The exception was the GDP of the country of origin. Between 2010 and 2017, the global economy grew rapidly as a result of globalization. As a result, GDP, a measure of income, had a significant and positive effect on the inbound tourist flows to France, which is consistent with the prediction of the gravity model and numerous studies (Neumayer & Plümper, 2016).

Table 4. Estimation results: Impact on inbound tourism.

| | B | Std. Error | Beta | Sig. |
|---|---|---|---|---|
| (Constant) | 43.875 | 35.925 | | 0.226 |
| $TerrN_t$ | 0.000 | 0.000 | -0.163 | ** |
| $TerrN_{t-1}$ | 0.000 | 0.000 | -0.326 | *** |
| $TerrN_{t-2}$ | 0.000 | 0.000 | -0.203 | ** |
| $TerrN_{t-3}$ | 0.000 | 0.000 | -0.145 | * |
| $TerrN_{t-4}$ | 0.000 | 0.000 | 0.144 | 0.103 |
| $TerrP_t$ | 0.006 | 0.006 | 0.098 | 0.301 |
| $TerrP_{t-1}$ | 0.006 | 0.006 | 0.093 | 0.328 |
| $TerrP_{t-2}$ | 0.000 | 0.006 | 0.007 | 0.935 |
| $TerrP_{t-3}$ | -0.007 | 0.006 | -0.106 | 0.225 |
| $TerrP_{t-4}$ | 0.006 | 0.006 | 0.089 | 0.314 |
| lgPOPfrc | -10.221 | 8.865 | -2.047 | 0.253 |
| lgPOPori | -0.038 | 0.178 | -0.080 | 0.834 |
| lgGDPfrc | 0.250 | 0.753 | 0.285 | 0.740 |
| lgGDPori | 1.170 | 0.615 | 2.306 | * |
| lgRCPI | -0.146 | 0.506 | -0.102 | 0.774 |

$R^2$=0.583; Adj.$R^2$=0.499; Durbin-Watson=2.079; Kolmogorov–Smirnov test sig.=0.089; White's test p-value=0.20; Average VIF=3.21.

*, **, and *** represent significance levels at 0.1, 0.05, and 0.01, respectively.

## Substitution effect for wine tourism

The second stage of the study examined the substitution effect for wine tourism as a result of terrorism. Three variables were used in the regressions to represent the varying levels of severity of the terrorist attacks and to examine their influences on the market shares of the seven major wine regions. Table 4 presents the results of the estimation.

Table 5. Estimation results: Substitution effect.

| | MSAuv | | MSBog | | MSGst | | MSNov | | MSOcc | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig. | B | Sig. | B | Sig. | B | Sig. | B | Sig. |
| (Constant) | 0.08 | *** | 0.04 | *** | 0.08 | *** | 0.03 | *** | 0.05 | *** |
| $TA^0t$ | 0.00 | 0.85 | 0.00 | 0.45 | 0.01 | 0.32 | 0.01 | 0.36 | 0.01 | 0.30 |
| $TA^0t$-1 | 0.00 | 0.95 | 0.00 | 0.85 | 0.00 | 0.99 | 0.00 | 0.73 | 0.00 | 0.71 |
| $TA^0t$-2 | -0.01 | 0.43 | 0.00 | 0.69 | 0.00 | 0.57 | 0.00 | 0.87 | 0.00 | 0.87 |
| $TA^0$_t-3 | 0.00 | 0.88 | 0.00 | 0.83 | 0.01 | ** | 0.01 | 0.40 | 0.00 | 0.83 |
| $TA^0$_t-4 | 0.01 | 0.70 | 0.00 | 0.92 | 0.00 | 0.58 | 0.01 | 0.54 | 0.00 | 0.77 |
| $TA^0$_t-5 | 0.01 | 0.43 | 0.00 | 0.92 | 0.00 | 0.71 | 0.00 | 1.00 | -0.01 | 0.43 |
| $TA^0$_t-6 | 0.00 | 0.99 | -0.01 | 0.26 | 0.00 | 0.83 | -0.01 | 0.49 | -0.02 | 0.16 |
| | | | | | | | | | | |
| $TA^{1t3}$_t | 0.01 | 0.60 | 0.01 | 0.42 | 0.00 | 0.94 | 0.00 | 0.66 | 0.00 | 0.81 |
| $TA^{1t3}$_t-1 | 0.01 | 0.70 | 0.00 | 0.72 | 0.00 | 0.76 | 0.00 | 0.64 | 0.01 | 0.63 |
| $TA^{1t3}$_t-2 | 0.00 | 0.95 | 0.00 | 0.91 | 0.00 | 0.70 | 0.00 | 0.88 | 0.00 | 0.96 |
| $TA^{1t3}$_t-3 | -0.01 | 0.74 | 0.00 | 0.88 | 0.00 | 0.50 | 0.00 | 0.94 | 0.00 | 0.93 |
| $TA^{1t3}$_t-4 | 0.00 | 0.97 | 0.01 | 0.11 | 0.00 | 0.68 | 0.01 | ** | 0.01 | 0.13 |
| $TA^{1t3}$_t-5 | 0.00 | 0.85 | 0.01 | 0.12 | 0.00 | 0.83 | 0.01 | ** | 0.01 | * |
| $TA^{1t3}$_t-6 | 0.00 | 0.74 | 0.01 | 0.20 | 0.01 | 0.23 | 0.01 | ** | 0.01 | 0.19 |
| | | | | | | | | | | |
| $TA^{3t}$_t | 0.02 | 0.32 | 0.00 | 0.73 | -0.01 | 0.36 | -0.01 | 0.56 | -0.02 | 0.13 |
| $TA^{3t}$_t-1 | 0.03 | * | 0.00 | 0.77 | 0.02 | ** | -0.01 | 0.48 | -0.02 | 0.10 |
| $TA^{3t}$_t-2 | 0.03 | * | 0.00 | 0.58 | -0.01 | 0.12 | -0.01 | 0.51 | -0.02 | 0.22 |
| $TA^{3t}$_t-3 | 0.01 | 0.60 | 0.00 | 0.86 | 0.00 | 0.80 | -0.01 | 0.53 | -0.01 | 0.63 |
| $TA^{3t}$_t-4 | 0.00 | 0.99 | 0.00 | 0.64 | 0.00 | 0.65 | 0.00 | 0.92 | 0.00 | 0.90 |
| $TA^{3t}$_t-5 | 0.00 | 0.87 | 0.01 | 0.44 | 0.00 | 0.92 | 0.01 | 0.53 | 0.01 | 0.72 |
| $TA^{3t}$_t-6 | 0.00 | 0.90 | 0.01 | 0.34 | 0.00 | 0.94 | 0.01 | 0.37 | 0.00 | 0.81 |
| $R^2$ | 0.17 | | 0.20 | | 0.23 | | 0.37 | | 0.28 | |
| *Durbin–Watson* | 1.81 | | 2.21 | | 2.30 | | 2.17 | | 2.06 | |
| *Average VIF* | 1.72 | | 1.72 | | 1.72 | | 1.72 | | 1.72 | |
| *Kolmogorov–Smirnov test* | 0.01 | | 0.20 | | 0.20 | | 0.02 | | 0.20 | |
| *White's test p-value* | 0.54 | | 0.42 | | 0.79 | | 0.80 | | 0.11 | |

Note: *, **, and *** represent significance levels at 0.1, 0.05, and 0.01, respectively.

Table 5 (continued). Estimation results: Substitution effect.

| | MSPays | | MSProv | |
|---|---|---|---|---|
| | B | Sig. | B | Sig. |
| (Constant) | 0.010 | *** | 0.102 | *** |
| $TA^0t$ | 0.001 | *** | -0.001 | 0.786 |

| | | | | |
|---|---|---|---|---|
| $TA^{0}$t-1 | 0.001 | * | 0.000 | 0.925 |
| $TA^{0}$t-2 | 0.001 | 0.112 | 0.002 | 0.277 |
| $TA^{0}$_t-3 | 0.001 | ** | 0.000 | 0.867 |
| $TA^{0}$_t-4 | 0.001 | ** | -0.001 | 0.821 |
| $TA^{0}$_t-5 | 0.000 | 0.808 | 0.003 | 0.326 |
| $TA^{0}$_t-6 | 0.000 | 0.814 | -0.003 | 0.250 |
| | | | | |
| $TA^{1t3}$_t | 0.001 | 0.219 | 0.002 | 0.480 |
| $TA^{1t3}$_t-1 | 0.001 | ** | 0.000 | 0.995 |
| $TA^{1t3}$_t-2 | 0.000 | 0.853 | 0.003 | 0.203 |
| $TA^{1t3}$_t-3 | 0.000 | 0.945 | -0.004 | 0.143 |
| $TA^{1t3}$_t-4 | 0.001 | 0.107 | 0.001 | 0.501 |
| $TA^{1t3}$_t-5 | 0.000 | 0.194 | 0.004 | ** |
| $TA^{1t3}$_t-6 | 0.001 | *** | -0.001 | 0.650 |
| | | | | |
| $TA^{3t}$_t | 0.000 | 0.410 | 0.002 | 0.376 |
| $TA^{3t}$_t-1 | 0.001 | 0.100 | 0.006 | ** |
| $TA^{3t}$_t-2 | 0.001 | * | 0.003 | 0.303 |
| $TA^{3t}$_t-3 | 0.001 | 0.431 | 0.003 | 0.429 |
| $TA^{3t}$_t-4 | 0.000 | 0.806 | 0.006 | * |
| $TA^{3t}$_t-5 | 0.001 | 0.118 | 0.004 | 0.318 |
| $TA^{3t}$_t-6 | 0.001 | 0.252 | 0.003 | 0.475 |
| $R^2$ | 0.598 | | 0.322 | |
| *Durbin–Watson* | 2.17 | | 2.21 | |
| *Average VIF* | 1.72 | | 1.72 | |
| *Kolmogorov–Smirnov test* | 0.20 | | 0.20 | |
| *White's test p-value* | 0.42 | | 0.22 | |

Note: *, **, and *** indicate significance at 0.1, 0.05, and 0.01, respectively.

The results indicate that terrorist attacks generally have significant positive correlations with the market shares of the wine destinations. This implies that when a terrorist attack occurred in an urban region of Paris or its peripheral areas, the market shares of each of the seven major wine tourism destinations increased. In this sense, international tourists preferred the wine regions as alternative destinations when terrorist attacks occurred in the urban destinations. This finding provides support for the claim that terrorism can have a substitution effect between different forms of tourism within a country and is consistent with the findings of Drako and Kutan (2003).

These results further demonstrate that terrorist attacks with varying levels of severity have different effects on market share. Primarily, the attacks that caused zero casualties had the least significant effects and only increased the market shares of Grand Est (after a three-period delay) and Pays-de-la-Loire. Of the seven study regions, these two are the closest wine destinations to Paris. This suggests that mild terrorist attacks had minimal effects on the market share and only had substitution effects on wine tourism destinations near Paris. In contrast, medium-level terrorist attacks (with fewer than three casualties) had a positive effect on the market shares of four wine regions. Specifically, Nouvelle-Aquitaine was affected by the fourth, fifth, and sixth lagged variables, Occitanie by the fifth lagged variable, Pays-de-la-Loire by the first and sixth lagged variables, and Provence-Alpes-Côte-d'Azur by the fifth lagged variable. These results suggest that medium-level terrorist attacks had stronger and longer-lasting effects than mild attacks even though they took more time to appear. Severe attacks (with more than three casualties) were also found to exert positive effects on the market shares of four wine tourism regions: Auvergne-Rhone-Alpes was affected by the first and second lagged variables, Grand Est and Pays-de-la-Loire by the second lagged variable, and Provence-Alpes-Côte-d'Azur by the first and fourth lagged variables. This suggests that the severe terrorist attacks had the most significant effects on market shares. Moreover, the time lags of the effects were much shorter than those of the mild and medium attacks.

In summary, the results of this study are consistent with the findings in the literature (e.g., Drako & Kutan, 2003). Terrorist attacks in the urban areas of Paris were found to affect the market shares of the wine regions, and substitution effects were found between the wine and urban tourism markets. However, the substitution effects differed for different levels of terrorism. Following mild terrorist attacks, tourists preferred Grand Est and Pays-de-la-Loire as substitutes, whereas for medium attacks, Nouvelle-Aquitaine, Occitanie, Pays-de-la-Loire, and Provence-Alpes-Côte-d'Azur were the preferred alternatives. In cases of severe attacks, Auvergne-Rhone-Alpes,

Grand Est, Pays-de-la-Loire, and Provence-Alpes-Côte-d'Azur were preferred. Overall, Pays-de-la-Loire was preferred following attacks of all levels of severity. Moreover, the substitution effects demonstrated different levels of significance under the different levels of terrorism. More severe attacks had more significant effects with shorter time lags for the responses. This finding is consistent with the results of Fletcher and Morakabati's (2008) study of Kenya and Fiji. Finally, unlike the effects on the inbound tourism flow, which occurred immediately, the substitution effects had time lags. This finding is reasonable because tourists may respond quickly to an emergency by canceling their travel plans, whereas it takes time to adjust a schedule and choose another form of travel.

# Discussion, conclusions, and implications

## Discussion and conclusions

Terrorism is a global challenge that has profoundly affected international tourism. Studies conducted in various contexts have consistently shown that terrorist attacks can cause a rapid decline in tourism demand in the incident region/country. This negative effect may also cause spatial contagion or substitution effects between the incident destination and its neighbors. In light of these findings, numerous tourism researchers have called for more in-depth empirical research in more contexts to validate the existing findings and extend our knowledge of this issue.

In response to these calls, this study examined the effects of terrorism on the international tourism market in a developed country, France. A two-stage investigation was conducted using econometric modeling based on time series data. The direct effects of terrorism on the inbound tourism flows to France and the substitution effects between the urban and wine tourism markets were estimated. Based on the results of the data analysis, the following conclusions can be drawn.

First, terrorist attacks reduced the inbound tourist flow to France during the study period. The intensity of an attack (i.e., the number of casualties) was negatively correlated with the inbound tourism demand. However, this effect was not related to the location of the incident. The negative effect of terrorism was found to have no time lag and could last around 3 months. This finding supports studies that have shown that terrorist attacks can scare off tourists and damage local tourism industries (e.g., Abadie & Gardeazabal, 2008) and that the negative effects are significant in developed countries, although some studies have found that they are minor in developed countries (Blomberg et al., 2004; Tavares, 2004).

Second, wine tourism served as a substitute for urban tourism after terrorist attacks. The terrorist attacks in the Paris area increased the market shares of France's major wine tourism regions. However, the strength of these substitution effects varied for attacks of different levels of severity. Compared with mild attacks, severe and medium attacks generated larger substitution effects, affected more wine regions, and appeared after short time lags. The substitution effects also varied across the different wine regions. Pays-de-la-Loire, Provence-Alpes-Côte-d'Azur, and Grand Est attracted the most tourists from the Paris area. There are several reasons for the differing preferences. The regions of Pays-de-la-Loire (145 miles from Paris) and Grand Est (157.30 miles from Paris) are close enough to divert tourists away from Paris in the event of terrorist attacks but they are not so close to share the negative impacts of terrorist attacks in the capital city. The region of Provence-Alpes-Côte-d'Azur, which is quite far from Paris (372.53 miles away), is a famous wine tourism destination and famous for its Mediterranean coast of the French Riviera, which is also the second leading tourist destination in the country (Tourism in France, 2019). Moreover, these three regions are more familiar to international tourists than the others. Warr (1990) suggested that familiarity with an environment leads to feelings of safety, whereas novel or unfamiliar environments are more likely to induce fear of victimization.

The results of this study confirm that terrorism affects the amount and pattern of

tourism demand. In addition to reducing the flow of inbound tourism, terrorist attacks can alter travelers' behavior by generating a substitution effect between different forms of tourism within a destination. Notably, as most wine tourism destinations (vineyards and wineries) are located in rural areas, it is difficult to strictly separate wine tourists from rural tourists. In fact, some scholars take wine tourism as an example of rural tourism (Carmichael, 2005). Thus, rural tourism can be considered a substitute for urban tourism following terrorist attacks because rural areas may appear to be safer than urban areas.

Overall, this study makes several contributions to the literature on terrorism and tourism. First, this study adds to the literature by examining the case of a developed country. Although developing countries tend to experience more terrorist attacks (Llorca-Vivero, 2008), the profound effects of terrorism on developed countries should not be neglected. First, developed countries have been increasingly targeted by terrorists since 9/11 (Institute for Economics and Peace, 2016). Second, many developed countries have suffered economically and have become increasingly reliant on tourism for economic development. Thus, terrorism can have devastating effects on tourism and the wider economy.

Second, this study adds to the research on substitution effects by examining the external effects of terrorism on different forms of tourism. Research has shown that terrorism can affect the countries involved, the neighboring countries and regions, and even the global tourism market (Edmonds & Mak, 2006). However, the literature on the external/substitution effects focuses mostly on the spatial dimension. This study adds to this line of research by confirming the existence of a substitution effect between different sectors of the tourism industry, providing a new perspective from which to examine the relationship between terrorism and tourism.

The findings of this study have a number of practical implications. First, the findings suggest that international destinations that suffer terrorist attacks may be able to offset the negative consequences of the attacks by developing less vulnerable

alternative forms of tourism (wine tourism in the case of France). Crisis management theory suggests that although terrorism often has negative consequences such as reducing demand and revenues (Kash & Darling, 1998), it may also provide opportunities to introduce new products and new markets (Okumus & Karamustafa, 2005). The findings of this study support this suggestion.

## Limitations and future research

The primary limitation of this study lies in the shortcomings of the compositional data. The substitution effect between the different forms of tourism was examined by focusing on the market share. However, this may have caused information contained in the data to have been lost. Information can also be lost in the computation of the raw data (e.g. weighted average of source markets). Future studies should use a combination of absolute data and compositional data to further examine the effects of terrorist attacks on tourism (Abuza, 2005; Kim & Gu, 2004). Moreover, the secondary dataset used by this study has certain deficiencies, as not all international tourist arrivals were included, not all wine regions/rural regions were taken into consideration, and changes in domestic patterns were not captured. Notably, a number of other French urban destinations have also suffered severe terrorist attacks (e.g. Nice). The substitution effect between wine tourism regions and other French urban destinations suffering from terrorist attacks is also worthy of investigation to generalize our research findings. Finally, the two secondary datasets provide different measures of tourist demand (number of nights in the first and number of persons in the second), and future research can consider a more consistent measure of tourism demand.

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